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IPv6 on Optical Networks

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ABSTRACT

The paper highlights the issues of optical networks with acquaintances of Internet protocol version 6 Enormous growth has been made in the previous years in cyber world. Now a days user are too demanding and they need more and more band-width with cheap cost. Which result in the result requirement of more address space to over come these issues so the users and scientist are drifting towards new address. Our approach is to establish a relation ship (with out electrical interference) between next generation protocol and cheap cost higher data rate Optical fiber.

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1. INTRODUCTION

Technology changes every minute and new competent are looking for new changes same things happens with cyber world new users are looking towards reliable internet connection with higher data rate. There are two different solutions to over come this issue one is wireless and second is optical fiber networks. Exponential demand of cyber world needs more addresses in the cyber world; solution of this problem is Internet protocol version six. This protocol provides more addresses to more users.

1.1) Why Optical Fiber?

Fiber is essentially a thin filament of glass which acts as a waveguide use to propagate electromagnetic waves, such as light. Total internal reflection is a reason behind this

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propagation with little loss. Fiber is crystal clear light, flexible, reliable in corrosive environments, and immune to electromagnetic interference, and does not cause signal interference between fibers last property is easily deployment. Silica dioxide or SiO2 is the substance namely glass is the core substance of it.

1.2) What is IPv6?

IPv6 is short for "Internet Protocol Version 6". IPv6 is the "next generation" protocol designed by the IETF to replace the current version Internet Protocol, IP Version 4 ("IPv4").Most of today's internet uses IPv4, which is now nearly twenty years old. IPv4 has been remarkably resilient in spite of its age, but it is beginning to have problems. Most importantly, there is a growing shortage of IPv4 addresses, which are needed by all new machines added to the Internet.IPv6 fixes a number of problems in IPv4, such as the limited number of available IPv4 addresses. It also adds many improvements to IPv4 in areas such as routing and network auto-configuration. IPv6 is expected to gradually replace IPv4, with the two coexisting for a number of years during a transition period (Michael Düser, 2002).

1.3) Overview of Routing Concepts IPv6

Information related to the path of is known as Routing information. It enables a node to determine given destination is reachable or not at that moments. It also calculates the route of the packet and its destination. Routing information can be either configured statically or obtained dynamically. Routers exchange routing information with one another through one or more dynamic routing protocols. Each router builds a local database, called the *Routing Information Base* (RIB) to store the exchanged routing information. A subset of this RIB is then selected to build a *Forwarding Information Base* (FIB) for the purpose of forwarding packets. The routing concepts are identical between IPv4 and IPv6. The goal of routing is to find a loop-free path for the destination address between any pair of end systems, and the best path is chosen according to some defined criteria at the time of route selection. Many of the existing dynamic routing protocols have been updated to support IPv6. Three well known routing protocols Routing Information Protocol (RIP) , Border Gateway Protocol (BGP), and Open Shortest Path First (OSPF) have been extended to support IPv6, resulting in Routing Information Protocol next generation (RIPng) is an interior gateway protocol (IGP), OSPFv3 (OSPF for IPv6) and BGP4+(Border Gateway Protocol (BGP for Ipv6), respectively. Another deployed routing protocol, Intermediate system to intermediate system (IS-IS), was also extended to support both IPv4 and IPv6.The choice of the routing protocol depends on many factors, such as the diameter of the routing domain, the size and complexity of the networks within the routing domain, the level of tolerance to changing network topology by applications, and the complexity and the ease of deployment of the routing protocol.(Qing Li,Tatuya Jinmei).These protocols are also supported by IPv4 and optical networks are easily supported by IPv4.Hence it is quite clear that these Optical network can easily work with IPv6 with out Optical Electronic Optical (OEO) conversion. One of the main design objectives for Optical Burst Switching (OBS) is to build a buffer less network, where user data travels transparently as an optical signal and cuts through the switches at very high rates. Buffer less transmission is important to OBS because electronic buffers require OEO conversion, which slows down transmission, and optical buffers are still quite impractical. In fact, as of today there is no way to store light, so the only possible optical buffering is to delay the signal through very long fiber lines. Some authors have explored the use of fiber delay lines (FDLs) because they can potentially improve network throughput and reduce burst loss probability(Chunming Qiao1, Myungsik Yoo).

1.4) Optical Switching Methods Over view.

The four switching methods generally we are discussing in the paper Optical burst switching (OBS), Optical packet switching (OPS), Wave length routing and Optical label switching.

Table 1.
Comparison of optical switching (Biswanath Mukherjee).

Property	Wave length Routing	Optical Burst Switching	Optical Packet Switching	Optical Label Switching
Granularity	Large	Middle	Small	Option
Limits of Hardware	Low	Lower	Higher	High
Optical Buffer	No	No	Yes	No
Wave length Converter	Yes/No	No	Yes	No
Electronic bottleneck.	Yes/No	No	Yes	No
Statistical Multiplexing	Low	High	Higher	High
Control Over Head	Lower	Low	Higher	High
Scalability	Low	Higher	High	Higher
Flexibility	Low	High	Higher	Higher
Cost	Low	Lower	Higher	High
Self-Similar Traffic	No Support	Support	No Support	Partial Supprt

We are stick to our main target that is Optical Label Switching (OLS)/OPS. It is another switching method. OLS processes and updates labels in control overhead to enable switching and forwarding flexibility. OLS could be implemented together with some of the switching granularities above. For example, we get Generalized Multi-Protocol Label Switching (GMPLS) when OLS is applied to WR networks. In OLS there is no OEO conversion take place, it means no electronic interface exist (Shengming Jiang, 2007).

2. OPTICAL PACKET SWITCHING (OPS) BASICS

Optical packet switching is optical switching with the finest granularity. Incoming packets are switched all-optically without being converted to electrical signal. It is the most flexible and also the most demanding switching scheme. There two main categories are is Slotted network and un-slotted network. When individual optical switches form a network, at the input ports of each node, packets can arrive at different times. Since the switch fabric can change its state incrementally (set up one input-output connection at an arbitrary time) or jointly (set up multiple input-output connections together at the same time), it is possible to switch multiple time-aligned packets together or to switch each packet individually called slotted Network. In an unslotted network, the packets may or may not have the same size. Packets arrive and enter the switch without being aligned in time. Therefore, the packet-by-packet switch operation could take place at any point in time. In both cases, bit-level synchronization and fast clock recovery are necessary for packet-header recognition and packet delineation. Obviously, in an unslotted network, the chance for contention is larger because the behavior of the packets is more unpredictable .On the other hand; unslotted networks are more flexible compared with slotted networks, since they are better at accommodating packets with variable sizes. The fixed-length fiber delay lines hold the packet when header processing and switch reconfiguration are taking place. There is no packet-alignment stage, and all the packets experience the same amount of delay with the same relative position in which they arrived, provided there is no contention. The unslotted network circumvents the requirement of synchronization stages. However, given the same traffic load, the network throughput is lower than that of the slotted networks because contention is more likely to occur.(Biswanath Mukherjee).This paper contemplates on unslotted networks with OLS to acquaintances with Internet Protocol version six.

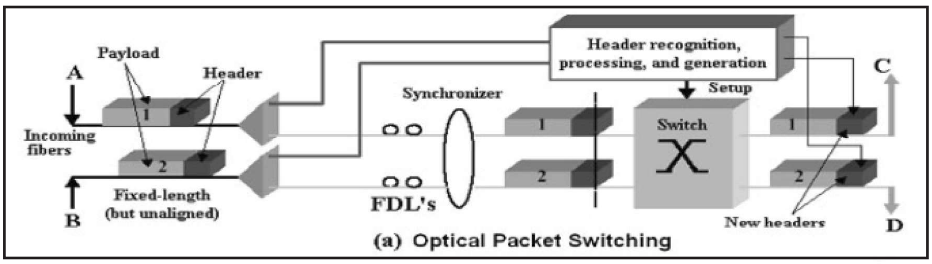
A new approach regarding header processing is presented by Calabretta (N. Calabretta, H. de Waardt, 2004). All-Optical header processing plays an important role in all-optical packet switching. In ultrafast all-optical header processing using a terahertz optical asymmetric demultiplexer (TOAD) is demonstrated at a bit rate of 250 Gb/s. TOAD-based header recognizer operates at low energy and allows photonic integration, but a dis advantage is that the control pulse should be synchronous with the header bits.

The design of the header processing system provides several advantages over alternative techniques. The HPP operates asynchronously which means that the header processing system as a whole can be operated in an asynchronous fashion. Also, the system operates at low power. The bit rate was 10 Gb/s , but optical switching of a 250-Gb/s signal has been demonstrated using a TOAD for which was 4 ps. Thus, we believe that the header processor can operate at higher bit rates than 10 Gb/s. Moreover, a shorter offset time in the order of few picoseconds allows photonic integration of the header processor. Finally, a header processing system that can recognize a large number of header patterns can be utilized in devising an all optical packet switch.

2.1 Headers and Packet Format

Electronic routers or switches will process the header information at the same data rate as the payload. In an optical network, the bandwidth may be much higher than their electronic counterparts. Although there are various techniques to detect and recognize packet headers at Gbps speed, either electronically or optically, it is costly to implement electronic header processors operating at such high speed. Among several different proposed solutions, packet switching with sub-carrier multiplexed (SCM) header is attracting increasing interest. In Optical Packet Switching (OPS) approach, the header and payload data are multiplexed on the same wavelength (optical carrier). In the current that modulates the laser transmitter, payload data is encoded as the base band signal. Detecting a small fraction of the light in the fiber with just a conventional photo detector, without any type of optical filtering, can retrieve the header information on different wavelengths. In the output current of the photo detector, various data streams from different wavelengths jam at base band, but the sub carrier remains distinct and an electrical filter can retrieve the header. A nice feature of a sub carrier-multiplexed header is that the header can be transmitted in parallel with the payload data and it can take up the whole payload transmission time.

Figure 1.
Optical packet switching method (Biswanath Mukherjee).



The header can also be transmitted serially with the pay-load, if so desired. One potential pitfall of a sub carrier-multiplexed header is its possible limit on the payload data rate. If the payload data rate is increased, the base band will expand and might eventually overlap with the sub carrier frequency, which is limited by the microwave electronics. There have been several approaches proposed for optical header replacement for headers transmitted serially with the payload data stream. Optical header replacement could be done by blocking the old header with a fast optical switch and inserting the new header, generated locally by another laser, at the proper time. One important issue here is that in a WDM network the new header should be precisely at the same wavelength as the payload data, otherwise serious problems could arise because of dispersion, nonlinearity, or Wavelength-sensitive devices in the network. (Biswanath Mukherjee)

Figure 2.
Unslotted Network (Biswanath Mukherjee)

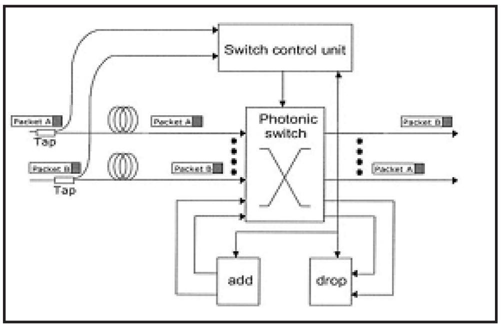
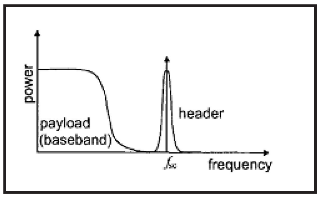


Figure 3.
Header in Optical Network (Biswanath Mukherjee).



Size of the header in optical network is up to 14 bytes and unique wavelength is associated with it. Same wavelength type payload associated with it. Our approach is to transmit this payload with out using optical electronic optical (OEO) converter. These converter slows transmission speed in optical network to the out side world. OLS/OPS is the only technique that is not taking any conversions in optical network, it reads only header by photo-detector as shown in Fig1.Now our next step to relate these network with IPv6.Details are as follows.

3. Internet Protocol Version Six.

3.1 NAT-PT

Protocol translation is easily achieved by the software named NAT-PT developed by Cisco IOS software was designed using RFC 2766 and RFC 2765 as a migration tool to help customers transition their IPv4 networks to IPv6 networks. Using a protocol translator between IPv6 and IPv4 allows direct communication between hosts speaking a different network protocol. Users can use either static definitions or IPv4-mapped definitions for NAT-PT operation. NAT-PT runs on a router between an IPv6 network and an IPv4 network to connect an IPv6-only node with an IPv4-only node.

NAT-PT is designed to be deployed to allow direct communication between IPv6-only networks and IPv4-only networks. For a service provider customer an example could be an IPv6-only client trying to access an IPv4-only web server. One of the benefits of NAT-PT is that no changes are required to existing hosts because all the NAT-PT configurations are performed at the NAT-PT router. Customers with existing stable IPv4 networks can introduce an IPv6 network and use NAT-PT to allow communication without disrupting the existing network. To further illustrate the seamless transition, File Transfer Protocol (FTP) can be used between IPv4 and IPv6 networks just as within an IPv4 network. Packet fragmentation is enabled by default when IPv6 is configured, allowing IPv6 and IPv4 networks to resolve fragmentation problems between the networks. Without the ability to resolve fragmentation, connectivity could become intermittent when fragmented packets might be dropped or improperly interpreted. Cisco has developed other transition techniques including dual stack, IPv6 over MPLS, and tunneling. NAT-PT should not be used when other native communication techniques exist. If a host is configured as a dual stack host with both IPv4 and IPv6, we do not recommend using NAT-PT to communicate between the dual stack host and an IPv6-only or IPv4-only host. NAT-PT is not recommended for a scenario in which an IPv6-only network is trying to communicate to another IPv6-only network via an IPv4 backbone or vice versa, because NAT-PT would require a double translation to be performed. In this scenario, tunneling techniques would be recommended (www.cisco.com/nat-pt).

3.2 Static NAT-PT Operation

Static NAT-PT uses static translation rules to map one IPv6 address to one IPv4 address. IPv6 network nodes communicate with IPv4 network nodes using an IPv6 mapping of the IPv4 address configured on the NAT-PT router. How the IPv6-only node named A can communicate with the IPv4-only node named C using NAT-PT. The NAT-PT device is configured to map the source IPv6 address for node A of 2001:0db8:bbbb:1::1 to the IPv4 address 192.168.99.2. NAT-PT is also configured to map the source address of IPv4 node C, 192.168.30.1 to 2001:0db8::a. When packets with a source IPv6 address of node A are received at the NAT-PT router they are translated to have a destination address to match node C in the IPv4-only network. NAT-PT can also be configured to match a source IPv4 address and translate the packet to an IPv6 destination address to allow IPv4-only hosts communicate with an IPv6-only host. If you have multiple IPv6-only or IPv4-only hosts that need to communicate, you may need to configure many static NAT-PT mappings. Static NAT-PT is useful when applications or servers require access to a stable IPv4 address. Accessing an external IPv4 DNS server is an example where static NAT PT can be used. (www.cisco.com/nat-pt)

3.3 Dynamic NAT-PT Operation

Dynamic NAT-PT allows multiple NAT-PT mappings by allocating addresses from a pool. NAT-PT is configured with a pool of IPv6 and/or IPv4 addresses. At the start of a NAT-PT session a temporary address is dynamically allocated from the pool. The number of addresses available in the address pool determines the maximum number of concurrent sessions. The NAT-PT device records each mapping between addresses in a dynamic state table. Shows how dynamic NAT-PT operates. The IPv6-only node B can communicate with the IPv4-only node D using dynamic NAT-PT. The NAT-PT device is configured with an IPv6 access list, prefix list, or route map to determine which packets are to be translated by NAT-PT. A pool of IPv4 addresses-10.21.8.1 to 10.21.8.10 is also configured. When an IPv6 packet to be translated is identified, NAT-PT uses the configured mapping rules and assigns a temporary IPv4 address from the configured pool of IPv4 addresses. Dynamic NAT-PT translation operation requires at least one static mapping for the IPv4

DNS server. After the IPv6 to IPv4 connection is established, the reply packets going from IPv4 to IPv6 take advantage of the previously established dynamic mapping to translate back from IPv4 to IPv6. If an IPv4-only host initiates the connection then the explanation is reversed (www.cisco.com/nat-pt).

3.4 Port Address Translation (PAT)

Port Address Translation (PAT), also known as Overload, allows a single IPv4 address to be used among multiple sessions by multiplexing on the port number to associate several IPv6 users with a single IPv4 address. The Port Address Translation can be accomplished through a specific interface or through a pool of addresses. Figure shows multiple IPv6 addresses from the IPv6 network linked to a single IPv4 interface into the IPv4 network.

3.5 IPv4-Mapped Operation

Customers can also send traffic from their IPv6 network to an IPv4 network without configuring IPv6 destination address mapping. A packet arriving at an interface is checked to discover if it has a NAT-PT prefix that was configured with the ipv6 nat prefix v4-mapped command. If the prefix does match, then an access-list check is performed to discover if the source address matches the access list or prefix list. If the prefix does not match, the packet is dropped. If the prefix matches, source address translation is performed. If a rule has been configured for the source address translation, the last 32 bits of the destination IPv6 address is used as the IPv4 destination and a flow entry is created (www.cisco.com/nat-pt).

4. Methodology.

Notion of this paper is to provide acquaintances between IPv6 and Optical Networks. In this paper we provide recommendations and techniques with different locale. Basic theme is to use OLC/OPS with IPv6.OLc and OPS that reads header not conversion the second part is to relate with IPv6 protocol.

Domain level source routing (DLSR)

DLSR is performed electronically at the ingress and/or egress of a domain. A DLSR route is expressed in a con-catenation of either (i) the identities of all the domains that a packet will go through to reach its destination for CL-DLSR or (ii) the indexes of each intra-domain route along which a packet will travel across the domain for CO-DLSR (www.cisco.com/nat-pt).

Domain-by-domain routing (DBDR)

CL-DLSR needs a domain connection first to provide Connection Less services across a domain by deciding an intra-domain route for a packet only upon its arrival. To efficiently support connectionless IP that is based on the node-by-node routing, DBDR is proposed. Different from CL-DLSR with DBDR. The ingress of each domain decides the next domain according to the destination address only upon a packet's arrival at the domain without requiring a pre-setup domain connection. It is similar to the node-by-node routing but different in routing units, which are routers for the node-by-node routing while domains for DBDR. After deciding the next domain, the ingress tries to find an intra-domain route corresponding to this domain and forward the packet to it through PLSR. Since it is impossible to all-optically perform the node-by-node routing cost-effectively for long addresses as mentioned earlier, DBDR is a reasonable choice of supporting the node-by-node routing. Particularly for the IP network, the destination address carried in the IP header can be used here to determine the next domain (Shengming Jiang, 2007).

Port level source routing (PLSR)

In an IP router, table lookup is required for every incoming packet to convert its IP address into the corresponding outgoing path across the router for routing. The similar operation is also needed in an ATM switch but with a much smaller table while re-writing the ATM header is also required for switching. It is very difficult to realize these operations all-optically as mentioned earlier. Accordingly, a PLSR-routed intra-domain route is expressed in a concatenation of the output port indexes (OPI) of all the nodes that a packet is going to visit. Thus, PLSR requires neither table lookup nor packet header re-writing operations to route a packet across a node, and only operation is to strip of, from the packet header, the OPI of the node currently visited by this packet. Therefore, such design is favorable for AOPS realization (Shengming Jiang, 2007).

This paper proposes following recommendations for optical network using IPv6.
" Cisco NAT-PT.
" Cisco Static NAT-PT Operation
" Cisco Dynamic NAT-PT Operation
" Cisco Port Address Translation (PAT) or Overload
" Cisco IPv4-Mapped Operation
" Domain level source routing (DLSR).
" Domain-by-domain routing (DBDR).
" Port-level source routing (PLSR).
" Encapsulation or Header Translation.

Port level source routing defines the path after looking into the routing table and sends the header with payload to its destination using OPS and OLS in optical switching methodology. Once the route is establish different wavelength of frequency transmitted over a network. Optical header contains 14 bytes of data with slightly different frequency of payload; headers are read by Optical label switching (OLS) and send to its destination. These 14 bytes of data can be send by different ports in IPv6 network the reason behind this we are not translating the header or converting it in to other format traffic speed is same now step two is to relate with IPv6 so one of the solution is port level source routing (PLSR). This routing works on both IPv4 and IPv6 protocols. In this combination makes packet traveling 100% in optical network with out electrical conversion.

5. Future Work and Open Issues

The future work in this area demands more bandwidth and optical header enhancement. IPV6 demands more research in optical communication networks. There are still deployment issues involved in PLSR and OLS. After deployment many open areas will also arise.

6. Conclusions

This is the contending topic in real time network. Our Aim is to provide you notion of thought about Optical network behavior with next generation protocol. IPv6 has a quality to communicate with IPv4 but IPv4 does not work with IPv6 based server so tunneling is required or port to port communication can resolve this issue. In optical network OPS and OLS are two switching mechanism that works on header reading not header translation or tunneling.If IPv4 user want to communicate with IPv6 server so software translation is necessary to link with its domain, then IPv6 based server wants to communicate with another IPv6 based server on optical network. OPS and OLS is the ways that need no OEO conversion or header translation or looking into routing tables. Smooth transition can be achieved with out degradation of optical communication data rate. This is an intriguing topic that creates acquaintances between these verges.

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